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Professor John Goulet
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December 13, 2007

Dear Professor Goulet:

Attached is one copy of the Interactive Qualifying report: **Student Teaching: North High School Worcester, MA**, Project Number JAJ 990.

Sincerely,

Catherine M. Maki

Catherine M. Maki

Student Teaching: North High School
An Interactive Qualifying Project Report
submitted to the Faculty
of the
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
Degree of Bachelor of Science

by

Catherine M. Maki

Catherine M. Maki

Date: October 11, 2007

Professor John Goulet, Major Advisor

1. mathematics
2. education
3. teaching

This report represents the work of one or more WPI undergraduate students
submitted to the faculty as evidence of completion of a degree requirement.
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Abstract

The process of a teaching practicum in the field of mathematics encompasses many attributes. Classroom management, syllabi development, and assessment are main teaching aspects that are learned through this experience and documented as a reference for curriculum and structure.

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INTRODUCTION:

This Interactive Qualifying Project assigned through the project based curriculum at Worcester Polytechnic Institute is a documentation of the student teacher experience in the field of mathematics. The practicum was completed at North High school, in Worcester, MA over the course of 10 weeks. I observed multiple courses and classroom behavior over 75 hours. I also had active classroom teaching for 150 hours. I created my own curriculum, as well as lesson plans, classroom activities, homework, and assessment. This was all created through the frameworks developed by the state of Massachusetts and the regulations of North High School. It is an account of the school and community that I was working in, a review the courses that I worked with, the course materials developed along with the thinking that went into their preparation, the members of the class I worked with and how they were assessed over the semester. This documentation is a synopsis of the time spent on developing classroom skills and the environment in which I did so.

Chapter 1:

North High school is located at 150 Harrington Way in Worcester, Massachusetts. It is a high school that teaches students in grade 9-12 and has a population of 1203 students. The student to teacher ratio is 17-1, which is higher than the Massachusetts average of 13-1. It is a culturally diverse community with 44% of the students being Caucasian, 30% being Hispanic, 18% being African American, 8% being Pacific Islander, and less than 1% with a Native American or Alaskan Native background. (Appendix 1) The North High mission statement states: "North High School is a family of learners committed to excellence. We provide our diverse population

of learners with a challenging curriculum in a safe and supportive atmosphere. Our school, parent and community partnership encourages high student achievement and provides all students with the opportunity to become informed, productive and responsible citizens.” The goal of North High school is educate students in all walks of life no matter their background or learning ability. The student expectations are academically and socially high at North High school (Appendix 2) They hire a well qualified staff and are primarily run by their Principal Mr. David Elworthy and three vice principals. The school is broken down into three sub-sections or smaller schools each run by an assigned vice principal. This allows for more control over students, ensuring safety, and smooth operations during school hours because of the large population on North High school. The students are allowed to choose which school they would like to enroll themselves in by their academic interests. These small schools do not limit the student’s academic learning but give them a chance to explore career paths and gain information on certain aspects of professional life. The three sub-schools are the health-science academy for students interested in biology, anatomy and physiology or any scientific field or hospital genre. The second school is the business, communications, design academy which puts its focus on the business world and its creative interactions with people. Lastly, the community academy which is focused on community service and serving others.

North High school being a diverse environment also has economic diversity. The state average of students in Massachusetts who qualify for the federal free and reduced lunch program is 28%; 59% of the students at North high school qualify for this program. (Appendix 3) This is an indication of the student’s economic level or family income because students from families with incomes at or below 130 % of the poverty level which is currently \$21,710 for a family of

four are eligible for free meals. Those students whose family income falls between 130% and 185% of the poverty level which is currently \$30,895 for a family of four are eligible for reduced-price meals, where students can be charged no more than 40 cents. Students from families with incomes over 185% of poverty pay a full price even though their meals are still funded to a certain degree.

To demonstrate the quality of the Worcester school system and North High school, an analysis of the total per pupil expenditures has been calculated according to greatschools.net. This dollar figure captures the cost of day-to-day operations of specific schools. This includes all costs except those associated with school construction, land acquisition and adult education. The instructional expenditures are the percentages of total per pupil expenditures spent on the cost of teachers instructing students. This number includes teacher salaries, supplies such as textbooks, and purchased instructional services. Next the student and staff support expenditures are calculated which show the percentage of total per pupil expenditures spent on student and staff support. Student support includes the cost of health, psychological, guidance and therapy departments at a school. Staff support includes the cost of school libraries, media centers and training. The administration expenditures are also calculated which show the percentage of total per pupil expenditures spent on the administration of both schools and school districts. This would include expenditures on the board of education, the office of the principal, graduation expenses, as well as central office expenses such as budgeting, payroll, purchasing, planning and research. Other expenditures include the percentage of total per pupil expenditures spent on utilities, maintenance and security, food service, and the salaries of support staff such as bus drivers and cafeteria workers. (Appendix 4)

North High school, like all school also has a large range of academic intelligence. They offer advance placement courses for those students who excel in certain subjects. In the 2007 academic year they offered AP classes in biology, calculus, chemistry, English literature and composition, European History, Spanish Language, U.S. History, World History, micro economics, and macro economics. They also offer a wide variety of honors courses, and level 1 intermediate courses. The 2006 MCAS results showed that 45% of the 10th grade students at North High school who took the exam were at or above the proficient level; which in turn means that they passed the exam. This was 4% higher than the average of students in the Worcester school district who scored at or above proficient; but it is drastically below the Massachusetts average of 67% of students who scored at the appropriate level. (Appendix 5)

Chapter 2:

North High school has created a course schedule for their students by taking on the block scheduling approach. This has strongly influenced the curriculum for the mathematics program, and the design sequence of math courses over a four course for a high school student. This means that most, not every class will run for a length of 99 minutes, 5 days a week, for one semester. Each course is taken for longer class periods over half a school year. This approach has many positives as well as negatives. When looking at the design of many mathematics courses it is more effective for a student to be learning the material over a full year. Every 10th grade students has to take and pass the MCAS exam according to the state of Massachusetts. One major section of this test is Mathematics. The test covers pattern, relations, algebra, geometry, probability, and statistics. Also, many 11th and 12th grade students take the SAT's in order to apply to college;

which also has one major section in mathematics that covers algebra, geometry, and probability, statistics. Students can be hindered by the block scheduling and not take a mathematics course for the equivalent of one full year, if they decide to not take a mathematics course 2nd semester and then again the next year during the 1st semester. These students are still developing their minds and by lessening their exposure to mathematics can affect the rest of their lives.

As freshman or first year high school student the suggested mathematics course is Algebra I. The next course in the sequence would be geometry, then Algebra II and Pre-Calculus. Many students who show high level skills in Mathematics are able to take geometry as their freshman level entry mathematics course and work their way up to taking Calculus as a senior. Each student is required to take four credits in mathematics in order to fulfill graduation requirements. Dealing with the other spectrum; the mathematics department at North High school is in the process of developing a new course that will take a lighter approach to mathematics. Many students find that math is their weakest educational point. A course in consumer mathematics with the underlying objective to teach students mathematical topics that they will be able to use in their everyday lives even if they do not see themselves in a career or situation where high level calculations would be necessary.

I have participated in all mathematical courses offered at North High school. I have observed Algebra I, pre-calculus, and calculus courses; as well as observed and completed my teaching practicum in geometry and algebra II. Each course is arranged in an order to cover the frameworks provided by the state of Massachusetts. Since, 1994 when the Department of Education in Massachusetts developed curriculum guidelines for the Commonwealth of

Massachusetts the Worcester school system has been thoroughly involved. These guidelines provide the direction that North high school must take to create and uphold the mathematics State Frameworks. Worcester initiated this curriculum development before the completed the frameworks were in place. As more frameworks became approved by the Board of Education Worcester Public Schools kept shaping their curriculum to the standards placed by the state. The curriculum has also been shaped around the MCAS tests because this test is based on the student's understanding of the material posed by the State Frameworks.

The first course in the Mathematics sequence is algebra I. Every freshman is required to take this course. This course is the first mathematics course because it lays the foundation for the basic knowledge students must understand in order to be successful in other mathematics courses over their high school career. Students who have showed excellence in the topics covered in algebra I are able to begin their sequence with Geometry. According to the Massachusetts Mathematics Curriculum Frameworks, students who complete algebra 1 are able to “identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of n th roots of positive real numbers for any positive integer n ; and the inverse relationship between taking the n th root of and the n th power of a positive real number.” (A1.N.1 frameworks p. 92); “simplify numerical expressions, including those involving positive integer exponents or the absolute value; apply such simplifications in the solution of problems” (A1.N.2 frameworks p. 92); and “find the approximate value for solutions to problems involving square roots and cube roots without the use of a calculator.” (A1.N.3 frameworks p. 92); Also students will be able “to solve equations and inequalities by demonstrating the

knowledge of symbolic manipulation by collecting like terms and rearranging the expression.” (A1.P.8 frameworks p. 93). These topics must be understood in order for success in the next course in the sequence, geometry.

Geometry is the second course in the mathematics sequence at North High school. Students’ are expected at the completion of this course to “identify figures using properties of sides, angles, and diagonals”; (G.G.1 frameworks p. 95); “recognize and solve problems involving angles formed by transversals of coplanar lines; identify and determine the measure of central and inscribed angles and their associated minor and major arcs; recognize and solve problems associated with radii, chords, and arcs within or on the same circle”; (G.G.6 frameworks p. 95); “solve simple triangle problems using the triangle angle sum property and the Pythagorean theorem”; (G.G.7 frameworks p. 95); “use the properties of special triangles to solve problems”; (G.G.8 frameworks p. 95); “use rectangular coordinates, calculate midpoints of segments, slopes of lines and segments, and distances between two points”; (G.G.12 frameworks p. 96); “find linear equations that represent lines either perpendicular or parallel to a given line and through a point”; (G.G.13 frameworks p. 96); . In order for a student to successfully complete the geometric work they must be proficient in the topics of algebra I to properly create and manipulate equations to solve for angle and side measures of figures. It is imperative that students understand how to solve for variables, square roots, and simplify expressions to find specific parts of figures, as well as midpoints, distance between two points, and the slope of a line. The understanding of geometric figures and the mathematical work that creates it is the second level in preparing students for the third course in the sequence, algebra II.

The third course that students will typically take in their mathematics sequence is algebra II. By the completion of this course students will be able to “define complex numbers and operations on them, in particular, addition, subtraction, multiplication, and division”; (AIL.N.1 frameworks p. 98); “simplify numerical expressions with powers and roots, including fractional and negative exponents” (AIL.N.2 frameworks p. 98); “demonstrate an understanding of the exponential and logarithmic functions;” (AIL.P.4 frameworks p. 99); “solve a variety of equations and inequalities using algebraic, graphical, and numerical methods, including the quadratic formula” (AIL.P.8 frameworks p. 99) ; “use matrices to solve systems of linear equations; apply these solutions to everyday problems” (AIL.P.9 frameworks p. 99) . This course is an extension of algebra I and takes an in-depth look at algebraic functions and expressions in a variety of ways. The material presented in algebra I is the major base for this course, but the understanding of geometric principles plays a role in the completion of the course as well. Students are introduced to point-slope form and understanding how to create the equation for a line in basic geometry. This information is important to the topics in algebra II because this course expands these equations and teaches students to manipulate the lines (i.e. move it up, down, left, right) and what factors affect the characteristics of the line on the graph. It also takes this topic a step further and introduces expressions that create conic sections and geometric shapes such as ellipses and circles. Without the base knowledge of solving simple expressions in algebra I and the geometric sense presented in basic geometry students would struggle with the topics posed in algebra II. This is the reason it is the third course in the mathematics sequence.

The fourth course in the sequence is pre-calculus. The topics covered in pre-calculus are “plotting complex numbers using both rectangular and polar coordinates systems; represent

complex numbers using polar coordinates, apply DeMoivre's theorem to multiply, take roots, and raise complex numbers to a power" (PC.N.1 frameworks p. 101); "use mathematical induction to prove theorems and verify summation formulas" (PC.P.1 frameworks p. 101); "relate the number of roots of a polynomial to its degree ;solve quadratic equations with complex coefficients" (PC.P.2 frameworks p. 101); "translate between geometric, algebraic, and parametric representations of curves; apply to the solution of problems" (PC.P.7 frameworks p. 102); "identify and discuss features of conic sections: axes, foci, asymptotes, and tangents; convert between different algebraic representations of conic sections" (PC.P.8 frameworks p. 102); "relate the slope of a tangent line at a specific point on a curve to the instantaneous rate of change" (PC.P.9 frameworks p. 102);. The three previous courses of algebra I, geometry, and algebra II provide the knowledge needed to solve these complex equations and translate geometric aspects of curves. Students need to be able to complete calculations of variables and complex numbers that were posed in algebra I and II and use those calculations to create graphs and geometric representations of the specific data there are working with. Pre-calculus is the pre-requisite for taking the last course in the sequence calculus.

Calculus is not a graduation requirement, but students who had proven that they already had proficient algebra I knowledge and took geometry as the first course in the mathematics sequence have the option to take calculus their senior year. The topics covered in calculus are limits, derivatives, integrals, and infinite series. Pre-calculus sets the base for these topics and the general knowledge of algebraic topics and geometric manipulation is essential to complete calculus coursework and understand the material presented.

Students who do not show particular skill in the area of mathematics have the option to take probability and statistics or consumer mathematics in place of algebra II, pre-calculus, and calculus. Algebra I must be taken before these courses then any sequence of geometry is appropriate.

The curriculum structure that North High school has created with-in its mathematics program has given students the opportunity to succeed in this field. It is created like most school systems in Massachusetts and builds up each course based on the previous knowledge gained through the prior coursework. This system has intricately placed its mathematics curriculum in a sequence that sets standards and attainable goals in order to become proficient and successful in multiple areas of mathematics.

Chapter 3:

Creating a lesson plan needs to be a thorough, intricate process. The teacher must have all knowledge of the subject at hand as well as background information to why a topic has been shaped and posed to the students. It is important for a teacher to be prepared for questions that will be asked, as well as be aware of what aspects of the lesson that may be more difficult for the students to grasp. The timeframe for each activity needs to be calculated and enough work needs to be taken into consideration in order to properly educate the students.

The process at North High school for the mathematics department is to fill out a daily lesson plan guide. These forms are dynamic and state the General topic that the unit is covering, the topic that will be specifically covered that day, the objective of the lesson and what the expected outcomes and knowledge the students will gain, the standards from the Massachusetts

frameworks addressed, literacy strategies used, an outline of the lesson plan activities, and the assessment that will be used during the lesson if any. (Appendix 6-12)

The lesson plans presented to the geometry class each touched upon and different geometric topic that built upon one another as presented in the text. Each class had the same structure where homework was corrected, new material was presented, group work was assigned and corrected and homework was given. The first unit lesson that was presented to the class was titled “Congruent Triangles”. (Appendix 6) The objective for this lesson was the have students learn and use the SSS, ASA, and AAS postulates to prove that specified triangles were congruent. This lesson addressed the first Massachusetts Learning Standard 10.G.1 in the geometry section for grades 9 and 10 that states that students must be able to “Identify figures using properties of sides, angles, and diagonals. Identify the figures’ type(s) of symmetry.” I began by discussing the previous night’s homework that was assigned prior to taking over the course from my mentor. I explained any questions students had and then assigned a worksheet to be done in groups that covered the previous material as a form of extra practice for the majority of students who struggled with the material. The class then reconvened and corrected the class work. I now proceeded to give the students a lecture where they were asked to take notes on the geometric postulates I was presenting. I gave them examples that we completed as a group and assigned four short problems for them to do on their own before class ended that we would correct and they could use as a source of help when completing their homework that I assigned for that evening. The next class was a continuation of the unit “Congruent Triangles” where old postulates were reviewed and new postulates were taught. After all the material on triangles congruence was covered a practice quiz was given as class work and the following day the

students were tested on their ability to identify and use these geometric properties, successfully covering the Massachusetts frameworks. (Appendix 6)

The next unit covered was “Perimeter and Area”. The first topic presented was finding the perimeter and area of rectangles, parallelograms, and triangles. This was a new topic so the class began by taking notes on the subject. Then in order to concretely and visually show the students how perimeter and area worked I presented with geoboards. Geoboards were small wooden tablets with spokes evenly distributed on the board. Students used elastic bands that wrapped around the spokes to count the number of units the figure had in height and width and used these numbers in the formulas they had learned from the lecture. This activity allowed the students to enjoy using the formulas and see how everyday shapes can be calculated. The next class fixed perimeter and area was introduced as well as area of trapezoids. The students were showed how to find maximum area with a given perimeter and minimum perimeter with a given area; as well as the formula to find the area of a trapezoid. The previous topics were reviewed as a base for the new information. This topic was difficult for many students to comprehend and two days were spent on exploring the topic. As a cumulative project students were put into groups of three or four and asked to complete the “Zoo Activity”. Students had to create the dimensions of a primate habitat that gave the greatest area for the animals with the given supplies. They were also asked to use their previous knowledge of algebra I and write expressions that formulated the total cost of supplies and create a colorful drawing of the habitat they created. This was used as the assessment for this chapter.

The next step in this unit was the circumference and area of a circle. Students were presented with the material to be able to identify and solve problems using the formulas for the circumference and area of a circle and understand the meaning of pi. After the material was explained and students completed group work and homework an activity was done that showed the relationship of circles and pi. I brought in many cylindrical household items and asked each student to choose one. Then they were to find the circumference, diameter, and radius and calculate the ration of circumference to diameter. In each case this ratio roughly equaled pi. It was a real world example that allowed the students to see that pi was not just a random number, but that it is precisely mathematically calculated.

The next in the unit was the Pythagorean Theorem. (Appendix 7) Students reviewed the rules of square roots and defined perfect squares. Then they were given the Pythagorean Theorem and examples of its use. After students became proficient with this topic a practice quiz was given that covered the topics in unit of perimeter and area that had been taught; followed by a quiz. Lastly, students learned the rules of special triangles (45-45-90, 30-60-90). They were given lecture notes, class work, and homework that ensured their success in the topic.

At this point in the semester the MCAS exam was quickly approaching. Along with covering the topics previously discussed the students reviewed the topics that they would need to be proficient in, in order to pass the exam. The first topic explained was number sense and operations. Lecture notes and review worksheets were assigned that covered certain vocabulary, converting decimals to fractions and fractions to decimals, rules dealing with negative and positive numbers, exponents, square roots, percentages and specified formulas. Next, they

reviewed patterns, relations, and algebra; where multiplying and factoring expressions, linear and quadratic functions, inequalities, and solving multi-step equations were reviewed. Probability and statistics was also covered where students were taught to set up proportions and solve sampling questions, find the mean, median, mode, range, and line of best fit, interpret and create scatter plot, stem-and-leaf plot, and box and whisker plot; as well as, circle and line graphs. The topics of probability and combinations were also covered. This review, as well as the geometric lessons that were taught throughout the semester, allowed students to engage in mathematical theory both analytically and explore real world options that precisely covered the Massachusetts Mathematical frameworks.

The second course I taught and created lesson plans for was algebra II. Similarly to the geometry course this mathematics course was set-up with a structure where homework was corrected, new material was presented, group work was assigned and corrected and homework was given. Each algebraic topic built upon one another and students were comprehensively tested on the knowledge of topics covered. The first lesson that I covered was in the unit of solving systems of linear equations and inequalities. (Appendix 8) The first topic was solving these systems graphically. The students were lectured on the how to solve the systems of equations and specific vocabulary then completed group work which was discussed and homework was assigned. Over the course of the next few classes, they were taught to solve these problems using the substitution and linear combinations method, as well as solve using matrices and inverse matrices. After students become capable of algebraically solving these systems I introduced how to solve them using a graphing calculator. This allowed them to fully understand how these systems could be solved by hand and when they used technology they were able to

evaluate the answers they got using their previous knowledge of how to solve systems of equations. At the completion of this material students were quizzed on solving systems of equations with two variables. (Appendix 9)

Building upon the knowledge of two variable systems students were exposed to solving 3×3 systems of linear equations using the methods that were previously covered. Lastly, in this unit students were taught to solve systems of equations of inequalities by graphing. They were given examples, class work, and homework covering solving 2×2 , 3×3 , and inequality systems as review and tested on all three types at the completion of the unit. (Appendix 10) This unit covered the Massachusetts Mathematics frameworks AII.P.9 and AII.P.10 which state that students must be able to “Use matrices to solve systems of linear equations; apply to the solution of everyday problems; use symbolic, numeric, and graphical methods to solve systems of equations and/or inequalities involving algebraic, exponential, and logarithmic expressions; use technology where appropriate.; describe the relationships among the methods.”

The next section that I covered was titled “Arithmetic Series”. (Appendix 10) The first topic that was covered was rational and irrational numbers. Students were expected to know how to simplify square root expressions and examine mathematical structures within real numbers. The Pythagorean Theorem and perfect squares were reviewed. This topic was then expanded to analyze imaginary and complex numbers as well as how to graph and determine the absolute value of complex numbers. (Appendix 11) This was an introduction to the following topic of quadratic functions. (Appendix 11) Students were taught to understand quadratic functions and the characteristics of parabolas. They were given the general form and specific characteristics of this graph then taught to graph the equations and understand how the coefficients effect and

translate these sketches. Next, students were given specific steps to complete the square when quadratic functions were presented in a specific form in order to solve. Now, they had the knowledge to put all the information of parabolas together and graphically solve these problems and find the number of real roots. After review students were quizzed on the quadratic formula and its various topics. (Appendix 12)

The last section I covered with the algebra II class was conic sections. (Appendix 12) The students had become proficient in the area of parabolas and I used that as the base for expanding on hyperbolas, circles, and ellipses. I gave real-world examples of where these graphs and shapes originate and why they are important to the mathematical world. I created graphs as a group activity with the students to help them understand where the different aspects of the conic sections originated from. We discussed the foci, major and minor axes, and created large versions of these figures for students to reference. I lectured about the relationship between the foci points and their relationship to the boundaries on the figure. I used an example of a specific dome where two people standing at the foci points of the dome can whisper and the other person on the other side of the dome can hear them because they are in the perfect position for their voice waves to bounce off the dome and hit the other foci point. After careful lecture, review, and real world scenarios the students were tested on all four conic sections and closed the unit.

The algebra II course was quickly paced and students grasped the analytical concepts much faster than the students in the geometry class. It was more imperative that I used everyday examples and projects in the geometry class because many of the students had different learning styles. Although, the topics were quite different in both class I had the same structure in place for

both class times. It was organized and allowed the students to become familiar with a schedule and my teaching style.

Chapter 4:

The dynamics of a classroom are created by the people within it. The learning environment is structured by the relationship between the students and the teacher. This environment can be very different from classroom to classroom depending upon the age level, intelligence level, and maturity of the students as well as the knowledge of the teacher.

The first class I was able to teach was a Level 1 Geometry course. The students who were placed in this class were at a low level of mathematical knowledge. They had each taken and passed Algebra I prior to being placed in this class. The general population was sophomores who were in their second phase of the mathematics curriculum. The majority of students had shown little knowledge in their first mathematics course and was not recommended by their previous teacher to be put in an honors level class. These students had showed a lack of commitment to the course work as well as an inability to accurately solve and analyze the mathematical material that was presented to them.

There was however a small percentage of the class that showed promising futures in the study of mathematics. There was a group of students who seemed to flock together who were above the average intelligence level of the class. One of these students was labeled with a behavior disorder but did not show any signs during my time at North High school. He worked well with others and recorded many well above average grades. He completed his homework and worked well with other. These students were always present and on-time to class participated in

discussions and completed their homework. I would often find students who were struggling in the course asking them questions during group work and MCAS review. It was my belief that these students should not have been placed in this class but instead in an honors level geometry. I believe they were actually put at a disadvantage because of the slow pace of the course. My mentor did inform me that at the completion of this geometry course the students would be recommended for the honors level Algebra II class. They were capable of learning so much more and broadening their horizons but were unable to because of the nature of the class.

There were also many behavioral issues that I faced with this class. The students who were labeled with behavior disorders were brought to my attention and I was shown their Individual Education Plan or IEP. This allowed me to approach my lesson in a manner that would suit the needs of the students in order for them to retain the most information. It also allowed me to be aware and prepared for any situation that may arise while teaching a lesson. There were five students that were categorized as Behavioral Disorder students; because of this factor there was always a teacher's aide present in the room while I performed my lesson for the day. If any of these students was to act up or be inappropriate at anytime the aide would take them outside the room or to the special education office where she would speak with them and discipline them in a manner that was approved by their IEP.

There were also three students who had IEP's who were not labeled with Behavior Disorders but had learning disabilities. Their IEP gave information on their learning techniques, whether they had better success with visual learning, audible learning or any other practices that gave the student a fair advantage within the classroom setting. Some of these students showed a

lack of focus in the classroom and had major trouble quickly grasping on to basic geometric theories. Many would get frustrated when completing their homework and some would not even attempt the work because they had already assumed failure. There were some who did take interest in the material being taught and asked questions and took part in discussions. For these students their participation wavered on a daily basis.

Attendance was a major factor in the success of this Geometry class. It was a first block class which meant that it was also the students' home room. There were 26 students in the class and it was a success if 50% were present for morning attendance. The policy of North High school is that if a student is late they are to report to the auditorium to receive a hall pass and wait until the second half of the block began to enter the class room. By the time the second half of the class was to begin another 5 students on average would attend class. If a student was absent for a third of the semester they would only get half credit for the course no matter the grade they had earned at the end of the semester. Many of these students had the ability and knowledge to thrive in this course but were unable to because of their inability to be prompt.

There seemed to be little parental guidance in dealing with the students. I was not approached by any parents or guardians in regards to students' grades or work progress. The averages of the students were not up to the standards posed by North High school. Possibility of failure forms were sent to parents whose child was in danger of not passing the class. These forms gave the guardian information as to what the student's current grade in the course was, how many days they had missed class, and missing assignments. After sending these forms by

mail I believed it appropriate to have parents or guardians contact the teacher and take interest in why some of these students were under achieving; which did not occur.

The teaching approach to this course was very different from traditional classroom style. The students were not self-motivated and therefore the technique needed to grab their attention and engage them in the theories of geometry.

Beginning class each day was a challenge because many students would be tardy or not attend class at all. To start each day as the students would walk into my classroom I would have an MCAS question on the board. They each had a specific notebook for these questions where they would do their analysis and try to come up with an answer. The MCAS questions were age appropriate because all of these students had to take and pass the MCAS at some point during their high school career as a graduation requirement. This gave them a chance to get organized in the classroom before learning the material for the day, as well as, prepare themselves and create a small study guide for the test. It was an incentive to be on time to class because students who were late to class were unable to get the extra MCAS practice. It also allowed for those who were a few minutes tardy to not miss any of the topic that would be covered that class.

The student's were not very organized so my mentor and I decided to give them all binders to keep their notes and assignments in. This helped when I would lecture because I would inform the class to take out their binders and they knew that it was time to learn the topic for the day. Lecturing was a small part of this classroom environment because the majority of the class would lose interest quickly. The topic would be introduced then to keep them interested they would either do a small project or group work to that was related to the topic.

The computer lab was also utilized during this geometry course. Every Wednesday the class was separated into two groups. For one half of the class they would learn a geometry lesson and for the other half of the class they would do MCAS math problem in the computer lab. This was a great resource because teaching in smaller groups helped individuals to be more open to asking questions and was a better setting for tackling pressing questions about specific geometric theories that students were struggling with.

To keep the classroom organized and in control I would walk around while students were completing work to make sure no one was misbehaving. Each student was assigned to work with 3 other students during group work. These groups were assigned by me to make sure that students were able to work with different people and not just those who were in their close social circle. It also allowed me to put students of comparable academic ability together. This allowed me to give those students who were excelling with the work more complex problems to attempt during these study times and give them a chance to surpass that limited topic that had been covered. As well as, allow those who were struggling to work in groups where I, my mentor, or the teacher's aide could give them special attention in order to understand the topic being presented.

The constant absence of the students from class made it very difficult to keep to a rigid lesson plan for a unit. For the majority when students were absent it was very difficult for them to understand the information they missed and make-up their work. It would set the entire class behind if multiple students were absent on a certain day. To the benefit of those who were absent and the majority of those who did attend class the material would be recovered. The students

seemed to be more successful when topics were reviewed on a daily basis and because of the multiple absences the lesson plans were stretched to get the best result. It seemed more important to make sure that most students understood the material that was being taught rather than giving them a brief overview of multiple topics.

The second class I had the pleasure of teaching was an Honors level Algebra II class. All of these students were very intelligent and enthusiastic about the topics of Mathematics being covered. They were all high school juniors who were in their 3rd sequence of the mathematics program. They had all taken honor geometry as sophomores and passed the course.

These students took part in lectures and in discussions. They asked questions and were able to look outside the general curriculum and find new ways of solving problems and help each other as well as myself learn. The students' kept up on their work and were always checking to make sure they had their assignments in. They were able to check their grades on an online database that showed their tests and quiz grades, homework grades, as well as missing assignments. This system kept the students very organized.

There were no students with behavioral issues or learning disabilities taking this specific course. There was however, one student who was re-taking the course because of a previous failure. This student showed a lack of focus, inconsistent attendance to class, make-up exams, and extra help sessions. There were also a few students, not many, who struggled with the material because of its difficult nature. I believe because of the caliber of students that were present in this class these students felt a need to succeed. They did not want to fail and showed ambition and asked questions privately during group work and especially before tests. They were

also willing to come to extra help sessions, whether they were held after school or during a lunch period.

The class' attendance was well above average. Many students would make me aware of an absence ahead of time and ask for the work they would be missing. They were prompt to class and many times if a student was late they had an appropriate hall pass.

There were no parental issues that became a factor during this course. There was one student whose father was concerned about her grades because at the beginning of the course this student's average was below the passing standard. The student was aware of the parents concern and their contact with the teacher and was able to pull up the grade. The student made their parents aware of any homework assignments, tests, and quizzes as well as asked for extra problems so that they could work on extra material covered in class.

This class allowed me to broaden my scope of teaching. The course was able to move at a swift pace because of the academic level of the student. I was able to lecture about a topic while the students took notes, as well as give specific examples that they could use for reference. This technique worked well because the students were already engaged in the topic. They were self motivated students who had the capability to sit quietly and focus on the task at hand.

The course was very structured. There would be a lecture and from there the students would take the information they gathered and put it to use, trying examples that I posed as class work. The students were able to work in groups during the class work because they were well behaved and this allowed them to question each other and help each other tackle a problem. I would walk around the classroom making sure students were working and answering any

questions that a student or group was struggling with. The work would then be corrected so the students' could see how well they were retaining the information. This particular group of student, being very ambitious, liked to present their answers and different students would take turn answering class work problems on the board explaining how they came to a specific conclusion.

It is a difficult task to engage students who are less outgoing in a class that is very ambitious. The technique I used was to make sure that everyone during the course of the week was able to speak to the class or answer a question. I would make sure to call on every student giving them a chance to partake in the discussion of the material. I would make some students who I knew got nervous to speak in front of crowds time to prepare their problem to try and give them confidence. Those who had trouble with the material I would tell them that we are going to go through it as a class but that I would like them to take the lead to begin the problem. It was important to make sure that those students who were consistently speaking out allowed others to participate and not feel overshadowed.

Although, these students were well behaved I still used a technique at the beginning of class to grab their attention and allow them to settle into class. Every day as the students would walk into my classroom I would have an SAT question on the board. They each had a specific notebook for these questions where they would do their analysis and try to come up with an answer. The SAT questions were age appropriate because most of these students would be taking the SAT's that coming spring. This gave them a chance to get organized in the classroom before

learning the material for the day, as well as, prepare themselves and create a small study guide for the test.

Dealing with the absence of students is always a hard thing for a teacher to tackle. This class had outstanding attendance but definitely not perfect. When a student knew they were going to be absent I was made aware of it. They would get their work and bring it back when they returned. North High school also sent out lists of students who were going on field trips or would be missing class for a school function. This allowed me to prepare those students' work and give them an appropriate date of completion. For unexpected absences I would approach the student and tell them the topic they had missed and any work they needed to make up. The expectation was that they were given as many days as they were absent to complete the work and turn it in. I would suggest finding a classmate to copy their notes from the previous class. I also offered extra help session to explain the topic and allow the student to ask any questions after class, as to not disturb the lesson for the day.

Chapter 5:

Assessment is a major part of evaluating students and the success of a course. It allows the teacher to evaluate their own teaching methods and how well the students are responding to their classroom environment. It also is an effective tool to show students their strength and weaknesses in a certain areas of a particular topic. Assessments are not just test and quizzes, but projects, homework assignments and participation are a major part. Each course is different and each teacher has a new and different approach.

In Geometry level 1 the students were assessed in many ways. Tests, quizzes, projects, homework assignments, and participation were the main areas that were taken into consideration. This group was very dynamic and all aspect of learning had to be taken into consideration in looking at the progress of these students.

A traditional approach to assessment was used to make up the majority of this class' grades. They would be given a quiz after each section of every chapter. The students knew that after a topic was fully covered there would be a quiz. The class before the quiz would review the topics and usually entail a practice quiz to prepare them for the assessment. After each chapter of the book was covered there would be a test. It would be a cumulative test of the topic that was covered on the previous quizzes for that specific chapter. As with the quizzes there would be a review day and practice test. The more grades the students were given the less one bad grade would affect their overall performance.

There were also multiple projects that the students completed over the semester. One project was done during class time in groups of 3 or 4. The students used their knowledge of perimeter and area to create an exhibit in a zoo. They were graded on the completion of their project, the quality of the work, and if it was handed in on time. Another project the students were involved in was called geo-boards. They were small boards with pegs that used rubber bands to create shapes. In creating these figures the students were able to calculate certain aspects of the designs. They were asked to create a figure and analyze it during a class period and submit the appropriate formulas to be graded. The students were assessed on their creativity of the figure and the use and precision of the formulas in their calculations. Other projects

included small word problem packets that were to be done for homework and MCAS open response review problems. Each of these projects was counted as a test grade.

The students were also graded on the binders that they were given at the beginning of the course. These notebooks were checked at the completion of each week. When assessing the notebooks the students' would have to have the notebook with them in class, the date and notes for each lecture day as well as any handouts from that specific week. If they were absent they were assumed to get the notes from a classmate or approach the teacher for extra help notes. If all the appropriate work was in the binder the students would get an extra 5 for a homework grade. If the notebook was insufficient they would get a homework grade in the range of 1-4 and if they forgot the binder they would get a zero. If a student was absent they were allowed to show the notebook at the next class meeting.

The MCAS test was a major factor in the assessment of the geometry class.

In the honors level Algebra II class the students were assessed in multiple ways as well. Tests, quizzes, homework assignments, and participation were the main areas that were taken into consideration. This group was conscious of their work which allowed for a more rigid structure of assessment.

A traditional approach of tests and quizzes was mainly used for assessment. As, with the geometry class, they would be given a quiz after each section of every chapter, and after each chapter of the book was covered there would be a test. It would be a cumulative test of the topic that was covered on the previous quizzes for that specific chapter. There was no review before quizzes. The students had strong study skills and were able to use their notes and homework to

study for the upcoming assessment because of the high level of academic success they had shown. There was however a review day before a major test because of the amount of in-depth information it would cover.

The algebra II class was not given any projects because of the nature of the course. It was a high-level mathematics course that had intricate topics that could be covered most effectively through lectures, examples, discussion, and group analysis; rather than individual or small group work on a minor topic.

For both courses homework was given on a daily bases. At the beginning of class I would walk around and put a check at the last problem the student had completed. Then after the homework was corrected the students would pass in the work. They would be graded on a scale of 1 to 5, with 5 being that they completed all the problems thoroughly no matter if the final answer was incorrect, to a 1 that represented work that was insufficient and incomplete showing little effort. At the end of the marking period an average of these homework grades would be taken. If the average was a 5 they would get a 100% averaged in with their test grades, if the average was a 4, they would receive a 90%, if it was a 3, they received an 80%, if it was a 2, they would receive a 70%, and if it was a 1, they would receive a 60%.

For both courses make-ups on tests and quizzes were also an option for any student. They were a different form of the previous assessment and only to be done after they had attended a help session outside and the make-up was to be completed outside of class hours. This ensured that the student had to put in the effort to learn the material and that was the main goal.

CONCLUSION:

The atmosphere, co-workers, students, and administration at North High School in Worcester, MA have lent a hand in developing the teaching basis for many aspiring mathematical teachers. It was an environment where learning and growing was the primary focus, but a place where values and intellect were challenged. It allowed me as a first-time teacher to step out of my comfort zone and experience high school for the second time in a new light. It is completely new territory taking the role of teacher instead of student. There are many new concerns and responsibilities. Making sure that the classroom is conducted in a proper manner, being impartial, and not tolerating any misdemeanors are among some of the hardest topics to grasp and ethically implement.

The main focus as a first-time teacher is to be organized and precise in lessons and to create the least distraction. In completing this project it is technically the students and mentor who are allowing a student-teacher to test their skills and knowledge. It is important that the students' interests are the main goal of this project. The MCAS exam is a critical part of the sophomore Geometry class that I taught. It was imperative that I understood all the material and portrayed it clearly. If a student did not perform their inadequacies was a reflection of my teaching efforts. On the other spectrum, to see a student succeed or put in the extra effort because as a teacher you took the time to break down a topic is also a manifestation of the work that was put into this project.

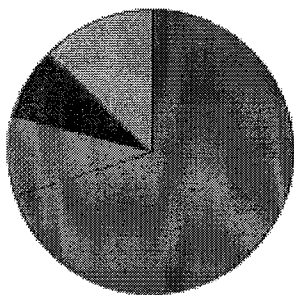
North High School was a welcoming journey into the career of teaching. I believe that it has thoroughly prepared me for teaching all levels of intellect. It has also taught me classroom

management and the ability to balance strict lecture driven courses with other types of educational tools. This IQP was a reflection of the knowledge that was sustained at WPI and the need for mathematical sciences to be a priority in all school systems.

Appendix 4

Spending Per Pupil

	This District	State Average
Total per pupil expenditures	\$12,910	\$11,642



Breakdown By Expenditure

■ Instructional	70%	64%
■ Student and staff support	9%	11%
■ Administration	8%	9%
■ Other expenditures	13%	16%

Source: NCES, 2004-2005

Spending Per Pupil

Total per pupil expenditures: This dollar figure captures the cost of day-to-day operation of schools. This includes all costs except those associated with school construction, land acquisition and adult education.

Instructional expenditures: This shows the percentage of total per pupil expenditures spent on the cost of teachers instructing students. This number includes teacher salaries, supplies such as textbooks, and purchased instructional services.

Student and staff support expenditures: This shows the percentage of total per pupil expenditures spent on student and staff support. Student support includes the cost of health, psychological, guidance and therapy departments at a school. Staff support includes the cost of school libraries, media centers and training.

Administration expenditures: This shows the percentage of total per pupil expenditures spent on the administration of both schools and school districts. This would include expenditures on the board of education, the office of the principal, graduation expenses, as well as central office expenses such as budgeting, payroll, purchasing, planning and research.

Other expenditures: This shows the percentage of total per pupil expenditures spent on all other types of expenditures. Examples of costs in this category include Operations (utilities, maintenance and security), Food Service, and the salaries of support staff such as bus drivers and cafeteria workers.

Source: National Center for Education Statistics, 2004-2005

Appendix 5

MCAS Results

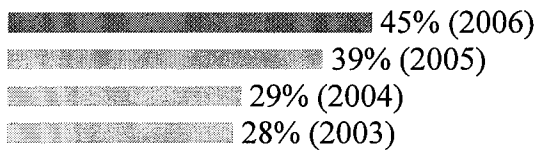
Scale: % at or above proficient

Grade 10

Math

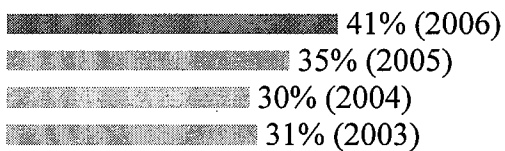
North High School

Math



Worcester School district

Math



0% 50% 100%

Source: MA Dept. of Education, 2005-2006

The state average for Math was 67% in 2006.

0% 50% 100%

Source: MA Dept. of Education, 2005-2006

About the Tests

- In 2005-2006 Massachusetts used the Massachusetts Comprehensive Assessment System (MCAS) to test students in grades 3 in reading and math, in grades through 4 through 8 and 10 in English language arts and math and in grades 5 and 8 in science.
- The MCAS is a standards-based test, which means it measures specific skills defined for each grade by the state of Massachusetts.
- The goal is for all students to score at or above proficient on the test.